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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

Technical Report on Development of USTES Aptitude Test Battery

For . . . .

Linotype Operator (print. & pub.) 650.582
S-128R

(Developed in Cooperation with the
Tennessee State Employment Service)

U.S. Department of Labor
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2164

Development of USTES Aptitude Test Battery

For

Linotype Operator (print. & pub.) 650.582-014

S-128R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Linotype Operator (print. & pub.) 650.582-014. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
V-Verbal Aptitude	80
P-Form Perception	85
K-Motor Coordination	85

Research Summary

Sample:

164 students enrolled at the Southern School of Printing, Nashville, Tennessee.

This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Instructor's ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .39 ($P/2 < .0005$)

Effectiveness of Norms:

Only 68% of the nontest-selected students used for this study were good students; if the students had been test-selected with the above norms, 81% would have been good students. Thirty-two percent of the nontest-

selected students used for this study were poor students; if the students had been test-selected with the above norms, only 19% would have been poor students. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Students	68%	81%
Poor Students	32%	19%

SAMPLE DESCRIPTION

Size:

N = 164

Occupational Status:

Students.

Training Setting:

Students were enrolled at the Southern School of Printing, Nashville, Tennessee.

Employment Requirements:

Education: None required.

Previous Experience: None required.

Tests: None used.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

All workers in the final sample had at least one month job experience.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience.

	Mean	SD	Range	r
Age (years)	24.3	4.9	18-45	-.116*
Education (years)	11.6	1.2	6-14	.182*
Experience (months)	6.4	2.5	1-16	.025

*Significant at the .05 level.

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002A were administered during the period July 1955 to October 1956.

CRITERION

The criterion consisted of instructors' ratings. Instructors used a four-point rating scale with the following categories:

1. Performance has indicated he (or she) likely wouldn't be able to make the grade as a working linotype operator.

2. Has shown the ability to become a "fair" linotype operator. If you were hiring, you would take him if you couldn't get anybody else.

3. Has shown the ability to become a "good" linotype operator. If you were hiring, you would be glad to have him.

4. Has shown the ability to become a "top-notch" linotype operator. You would hire him in preference to most any other prospect.

DK. Didn't get to know him.

Four is the highest rating and one is the lowest. It was possible to secure (1) ratings by Instructors A and B on 83 students, (2) two ratings by Instructor A on 54 students, and (3) one rating by either Instructor A or B on 27 students. The product-moment correlation between ratings made by Instructor A and Instructor B was .76, indicating good agreement between the two sets of ratings. The product-moment correlation between ratings and reratings made by Instructor A was .80 indicating good agreement between the ratings and reratings. Twenty-seven students were rated just once. The ratings made by Instructors A and B or by Instructor A (rating and reratings) were added together for each student. The ratings

for those students who were rated once by either Instructor A or Instructor B were multiplied by 2 . The final ratings ranged from 2 through 8, with 8 being the highest rating. The totalled ratings were then grouped into 7 broad categories to form the final criterion. The broad category ratings ranging from 2 to 8 were converted into quantitative scores of 67, 60, 53, 47, 4 2, 36, and 31 with 67 being the quantitative score for the highest rating score (8).

Criterion Dichotomy:

The criterion distribution was dichotomized into high and low groups by placing 32% of the sample into the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers". The criterion critical score is 47.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Tables 3, 4 , and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performed)

Aptitude	Rationale
G - General Learning Ability	Required in learning various phases of this occupation and in following detailed written and oral instructions accurately.
V - Verbal Aptitude	Required in understanding the meaning of words when reading copy and written instructions.
S- Spatial Aptitude	Required in making visual comparisons and discriminations and in seeing slight differences in shapes of type and other forms used in the job. Also required in visualizing completed jobs and in using good basic design, balance and fitness of type-face and spacing.
Q - Clerical Perception	Required in avoiding and detecting errors in setting type and in reading copy.
M - Manual Dexterity	Required in operating linotype keyboard rapidly and accurately and in using arms and hands rapidly in setting and breaking up type.

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N=164.

	Mean	SD	Range	r
G - General Learning Ability	101.8	12.9	71-130	.356**
V - Verbal Aptitude	97.7	13.9	68-133	.238**
N - Numerical Aptitude	101.1	13.4	69-128	.375**
S - Spatial Aptitude	105.2	16.1	65-143	.233**
P - Form Perception	100.8	15.7	62-140	.347**
Q - Clerical Perception	100.8	13.3	75-136	.299**
K - Motor Coordination	100.3	17.0	50-140	.314**
F - Finger Dexterity	94.9	19.8	49-147	.257**
M - Manual Dexterity	103.5	21.3	40-155	.243**

**Significant at the .01 level.

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X	X		X		X			X
Irrelevant									
Relatively High Mean	X			X					X
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation With Criterion	X	X	X	X	X	X	X	X	X
Aptitudes to be Considered for Trial Norms	G	V	N	S	P	Q	K	F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, V, N, S, P, Q, K, F and M at trial cutting scores were able to differentiate between the 68% of the sample considered to be good workers and the 32% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of V-80, P-85 and K-85 provided optimum differentiation for the occupation of Linotype Operator (print. & pub.) 650.582-014. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .39 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms
V-80, P-85 and K-85

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Students	20	92	112
Poor Students	30	22	52
Total	50	114	164

Phi Coefficient = .39 Chi Square (X^2_y)=24.7

Significance Level = P/2 < .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-29 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .17 is obtained with the OAP-29 norms of V-90, Q-100 and K-90.

FACT SHEET

Job Title

Linotype Operator (print & pub.) 650.582-014

Job Summary

Operates the keyboard of a machine that selects and assembles matrices of letters into lines and casts them in type metal used for printing.

Work Performed

Prepares linotype machine for operation - Receives copy from supervisor or directly from composing room, together with information on the size and style of type, length of line and other measurements, and places it in position on copyboard; selects magazine of proper size and style of matrices and brings it into operating position by turning handwheel on machine; adjusts assembler gage and marginal stops for width and thickness of line to be formed; may use micrometer to check the height and width of test type; selects proper sized mold by turning handwheel, sets gage on mold according to width and thickness of line to be cast, and spaces trimming knife according to gage on mold.

Operates keyboard of machine - Depresses keys on keyboard of machine to assemble matrices and spacebands in a line in assembly elevator, in same order as indicated on copy; inserts blank matrices to balance the line and to fill the width of line properly; presses hand lever, as each line is completed, to actuate an elevator which carries the matrices to the mold where molten metal is cast against them to form a slug; continues the process for each line of the copy and transfers completed galley of type to composing table for proofing; may operate a linotype machine equipped with a teletypesetter, threading rolls of perforated control paper through the attachment and tending the machine as keys are electrically depressed by the attachment; resets lines of type from corrected proofs.

May perform other related duties - Draw proof of galley type and forward it to proofreader for corrections; wash ink from face of galley of type, using benzene and a brush; set type by hand; assemble and lock type in forms; add new pigs of type metal to melting pot to replenish supply; make minor adjustments and repairs to keep machine in proper working order.

Effectiveness of Norms

Only 68% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the S-128R norms, 81% would have been good workers. 32% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the S-128R norms, only 19% would have been poor workers.

Applicability of S-128R Norms

The aptitude test battery is applicable to jobs which include a majority of duties described above.

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